



[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 23

[Docket No. FAA-2013-0781; Special Conditions No. 23-261-SC]

Special Conditions: Cirrus Design Corporation, Model SF50; Inflatable Three-Point Restraint Safety Belt with an Integrated Airbag Device

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions; request for comments.

SUMMARY: These special conditions are issued for the Cirrus Design Corporation (Cirrus), model SF50. This airplane will have novel and unusual design features associated with installation of an inflatable three-point restraint safety belt with an integrated airbag device at the pilot and co-pilot seats to include optional installations at other passenger seat locations. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

DATES: The effective date of these special conditions is **[INSERT DATE OF PUBLICATION IN FEDERAL REGISTER]**.

We must receive comments by **[INSERT DATE 30 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER.]**

ADDRESSES: Send comments identified by docket number [FAA-2013-0781] using any of the following methods:

- ☐ Federal eRegulations Portal: Go to <http://www.regulations.gov> and follow the online instructions for sending your comments electronically.
- ☐ Mail: Send comments to Docket Operations, M-30, U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE., Room W12-140, West Building Ground Floor, Washington, D.C., 20590-0001.
- ☐ Hand Delivery of Courier: Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, S.E., Washington, D.C., between 9 a.m., and 5 p.m., Monday through Friday, except Federal holidays.
- ☐ Fax: Fax comments to Docket Operations at 202-493-2251.

Privacy: The FAA will post all comments it receives, without change, to <http://regulations.gov>, including any personal information the commenter provides. Using the search function of the docket web site, anyone can find and read the electronic form of all comments received into any FAA docket, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). DOT's complete Privacy Act Statement can be found in the Federal Register published on April 11, 2000 (65 FR 19477-19478), as well as at <http://DocketsInfo.dot.gov>.

Docket: Background documents or comments received may be read at <http://www.regulations.gov> at any time. Follow the online instructions for accessing the docket or go to the Docket Operations in Room W12-140 of the West Building Ground Floor at 1200

New Jersey Avenue, SE., Washington, D.C., between 9 a.m., and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Mr. Bob Stegeman, Federal Aviation Administration, Aircraft Certification Service, Small Airplane Directorate, ACE-111, 901 Locust, Kansas City, Missouri, 816-329-4140, fax 816-329-4090.

SUPPLEMENTARY INFORMATION:

The FAA has determined that notice and opportunity for prior public comment is impractical because these procedures would significantly delay issuance of approval and thus delivery of the affected aircraft. In addition, the substance of these special conditions has been subject to the public comment process in several prior instances with no substantive comments received. The FAA, therefore, finds that good cause exists for making these special conditions effective upon issuance.

Comments Invited

We invite interested people to take part in this rulemaking by sending written comments, data, or views. The most helpful comments reference a specific portion of the special conditions, explain the reason for any recommended change, and include supporting data. We ask that you send us two copies of written comments.

We will consider all comments we receive on or before the closing date for comments. We will consider comments filed late if it is possible to do so without incurring expense or delay.

We may change these special conditions based on the comments we receive.

Background

On September 9, 2008, Cirrus applied for a Type Certificate for their new Model SF50. The SF50 is a single-engine turboprop powered jet that can carry up to seven occupants.

This aircraft will include a three-point safety belt restraint system with integrated airbags for the pilot and co-pilot seats. The aircraft will have airbags as a standard feature on all of the pilot and copilot seat locations with optional airbags offered at other passenger locations. Optional locations must meet all applicable special conditions.

The inflatable restraint systems are a three-point safety belt restraint system consisting of a lap belt and shoulder harness with an inflatable airbag attached to the lap belt. The inflatable portion of the restraint system will rely on sensors to activate the inflator electronically for deployment.

When activated, the airbags will inflate and provide a protective cushion between the occupant's head and the structure within the airplane. This will reduce the potential for head and torso injury. The inflatable restraint behaves in a manner similar to an automotive airbag; however, in this case, the airbag is integrated into the lap belt. While airbags and inflatable restraints are standard in the automotive industry, the use of an inflatable restraint system is novel for general aviation operations.

The FAA has determined that this project will be accomplished based on providing the same current level of safety as the conventional certification basis airplane occupant restraint systems. The FAA has two primary safety concerns with the installation of airbags or inflatable restraints:

- They perform properly under foreseeable operating conditions; and

- They do not perform in a manner or at such times as to impede the pilot's ability to maintain control of the airplane or constitute a hazard to the airplane or occupants.

The latter point has the potential to be the more rigorous of the requirements. An unexpected deployment while conducting the takeoff or landing phases of flight may result in an unsafe condition. The unexpected deployment may either startle the pilot or generate a force sufficient to cause a sudden movement of the control yoke. Either action could result in a loss of control of the airplane, the consequences of which are magnified due to the low operating altitudes and speeds during these phases of flight. The FAA has considered this when establishing these special conditions.

The inflatable restraint system relies on sensors to activate the inflator electronically for deployment. These sensors could be susceptible to inadvertent activation, causing deployment in a potentially unsafe manner. The consequences of an inadvertent deployment must be considered in establishing the reliability of the system. The applicant must show that the effects of an inadvertent deployment in flight are not a hazard to the airplane or that an inadvertent deployment is extremely improbable. In addition, general aviation aircraft are susceptible to a large amount of cumulative wear and tear on a restraint system. The potential for inadvertent deployment may increase because of this cumulative damage. Therefore, the impact of wear and tear on inadvertent deployment must be considered. The effect of this cumulative damage means a life limit must be established for the appropriate system components in the restraint system design.

There are additional factors to be considered to minimize the chances of inadvertent deployment. General aviation airplanes are exposed to a unique operating environment, since

the same airplane may be used by both experienced and student pilots. The effect of this environment on inadvertent deployment must be understood. Therefore, qualification testing of the firing hardware/software must consider the following:

- The airplane vibration levels appropriate for a general aviation airplane; and
- The airplane inertial loads that result from typical flight or ground maneuvers, including gusts and hard landings.

Any tendency for the firing mechanism to activate as a result of these loads or acceleration levels is unacceptable.

Other influences on inadvertent deployment include High Intensity Electromagnetic Fields (HIRF) and lightning. Since the sensors that trigger deployment are electronic, they must be protected from the effects of these threats. To comply with HIRF and lightning requirements, the inflatable restraint system is considered a critical system, since its inadvertent deployment could have a hazardous effect on the airplane.

Given the level of safety of the occupant restraints currently installed, the inflatable restraint system must show it will offer an equivalent level of protection for an emergency landing. If an inadvertent deployment occurs, the restraint must still be at least as strong as a Technical Standard Order approved belt and shoulder harnesses. There is no requirement for the inflatable portion of the restraint to offer protection during multiple impacts, where more than one impact would require protection.

The inflatable restraint system must deploy and provide protection for each occupant under an emergency landing condition. The seats of the model SF50 airplanes are certificated to the

structural requirements of § 23.562; therefore, the test emergency landing pulses identified in § 23.562 must be used to satisfy this requirement.

A wide range of occupants may use the inflatable restraint; therefore, the protection offered by this restraint should be effective for occupants that range from the fifth percentile female to the ninety-fifth percentile male. Energy absorption must be performed in a consistent manner for this occupant range.

In support of this operational capability, there must be a means to verify the integrity of this system before each flight. Cirrus may establish inspection intervals where they have demonstrated the system to be reliable between these intervals.

An inflatable restraint may be “armed” even though no occupant is using the seat. While there will be means to verify the integrity of the system before flight, it is also prudent to require unoccupied seats with active restraints not constitute a hazard to any occupant. This will protect any individual performing maintenance inside the cockpit while the aircraft is on the ground. The restraint must also provide suitable visual warnings that would alert rescue personnel to the presence of an inflatable restraint system.

In addition, the design must prevent the inflatable seatbelt from being incorrectly buckled and/or installed such that the airbag would not properly deploy. Cirrus may show that such deployment is not hazardous to the occupant and will still provide the required protection.

The cabin of the Cirrus model SF50 airplane is a confined area and the FAA is concerned that noxious gasses may accumulate if the airbag deploys. When deployment occurs, either by design or inadvertently, there must not be a release of hazardous quantities of gas or particulate matter into the cockpit.

An inflatable restraint should not increase the risk already associated with fire. Therefore, the inflatable restraint should be protected from the effects of fire to avoid creating an additional hazard by, for example, a rupture of the inflator.

Finally, the airbag is likely to have a large volume displacement, and possibly impede the egress of an occupant. Since the airbag deflates to absorb energy, it is likely that the inflatable restraint would be deflated at the time an occupant would attempt egress. However, it is appropriate to specify a time interval after which the inflatable restraint may not impede rapid egress. Ten seconds has been chosen as reasonable time. This time limit will offer a level of protection throughout the impact event.

Type Certification Basis

Under the provisions of 14 CFR 21.17, Cirrus must show that the model SF50 meets the applicable provisions of part 23, as amended by amendment 23-62 thereto.

If the Administrator finds that the applicable airworthiness regulations (i.e., 14 CFR part 23, Amendment 23-62) do not contain adequate or appropriate safety standards for the SF50 because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

In addition to the applicable airworthiness regulations and special conditions, the SF50 must comply with the fuel vent and exhaust emission requirements of 14 CFR part 34, amendment 34-4, and the noise certification requirements of 14 CFR part 36, amendment 36-28; and the FAA must issue a finding of regulatory adequacy under § 611 of Public Law 92-574, the "Noise Control Act of 1972."

The FAA issues special conditions in accordance with §§ 11.19 and 11.38 and they become part of the type certification basis under § 21.17(a)(2).

Special conditions are initially applicable to the model for which they are issued. Should the type certificate for that model be amended later to include any other model that incorporates the same novel or unusual design feature, the special conditions would also apply to the other model.

Novel or Unusual Design Features

The SF50 will incorporate the following novel or unusual design feature:

A three-point safety belt restraint system incorporating an inflatable airbag.

Discussion

The SF50 will have novel and unusual design features associated with installation of an inflatable three-point restraint safety belt with an integrated airbag device at the pilot and co-pilot seats. The manufacturer will also offer optional airbags at other passenger locations. Optional locations must meet all applicable special conditions. The purpose of the airbag is to reduce the potential for injury in the event of an accident. In a severe impact, an airbag will deploy from the lap belt in a manner similar to an automotive airbag. The airbag will deploy between the head of the occupant and airplane interior structure, which will provide some protection to the head of the occupant. The restraint will rely on sensors to activate the inflator electronically for deployment.

Section 23.562 states performance criteria for seats and restraints in an objective manner. However, none of these criteria is adequate to address the specific issues raised concerning inflatable restraints. Therefore, the FAA has determined that, in addition to the requirements of

parts 21 and 23, special conditions are needed to address the installation of this inflatable restraint.

Accordingly, these special conditions are adopted for the Cirrus Design Corporation Model SF50 airplane equipped with three-point inflatable restraints. Other conditions may be developed, as needed, based on further FAA review and discussions with the manufacturer and civil aviation authorities.

Applicability

As discussed above, these special conditions are applicable to the model SF50 equipped with the three-point inflatable restraint systems. Should Cirrus Design Corporation apply at a later date for a change to the type certificate to include another model incorporating the same novel or unusual design feature, the special conditions would apply to that model as well.

Conclusion

This action affects only certain novel or unusual design features on model SF50 airplanes. It is not a rule of general applicability and it affects only the applicant who applied to the FAA for approval of these features on the airplane.

The substance of these special conditions has been subjected to the notice and comment period in several prior instances and has been derived without substantive change from those previously issued. It is unlikely that prior public comment would result in a significant change from the substance contained herein. Therefore, because a delay would significantly affect the certification of the airplane, which is imminent, the FAA has determined that prior public notice and comment are unnecessary and impracticable, and good cause exists for adopting these special conditions upon issuance. The FAA is requesting comments to allow interested persons

to submit views that may not have been submitted in response to the prior opportunities for comment described above.

List of Subjects in 14 CFR Part 23

Aircraft, Aviation safety, Signs and symbols.

Citation

The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(g), 40113 and 44701; 14 CFR 21.16 and 21.17; and 14 CFR 11.19 and 11.38.

The Special Conditions

Accordingly, pursuant to the authority delegated to me by the Administrator, the following special conditions are issued as part of the type certification basis for the Cirrus Design Corporation Model SF 50 airplane.

1. Inflatable Three-Point Restraint Safety Belt with an Integrated Airbag Device

a. It must be shown that the inflatable restraint will deploy and provide protection under crash conditions. Compliance will be demonstrated using the dynamic test condition specified in § 23.562(b)(2). It is not necessary to account for floor warpage, as required by § 23.562(b)(3), or vertical dynamic loads, as required by § 23.562(b)(1). The means of protection must take into consideration a range of stature from a 5th percentile female to a 95th percentile male. The inflatable restraint must provide a consistent approach to energy absorption throughout that range.

b. The inflatable restraint must provide adequate protection for each occupant. In addition, unoccupied seats that have an active restraint must not constitute a hazard to any occupant.

c. The design must prevent the inflatable restraint from being incorrectly buckled and/or incorrectly installed such that the airbag would not properly deploy. Alternatively, it must be shown that such deployment is not hazardous to the occupant and will provide the required protection.

d. It must be shown that the inflatable restraint system is not susceptible to inadvertent deployment as a result of wear and tear or inertial loads resulting from in-flight or ground maneuvers (including gusts and hard landings) that are likely to be experienced in service.

e. It must be extremely improbable for an inadvertent deployment of the restraint system to occur, or an inadvertent deployment must not impede the pilot's ability to maintain control of the airplane or cause an unsafe condition (or hazard to the airplane). In addition, a deployed inflatable restraint must be at least as strong as a Technical Standard Order (C114) certificated belt and shoulder harness.

f. It must be shown that deployment of the inflatable restraint system is not hazardous to the occupant or result in injuries that could impede rapid egress. This assessment should include occupants whose restraint is loosely fastened.

g. It must be shown that an inadvertent deployment that could cause injury to a standing or sitting person is improbable. In addition, the restraint must provide suitable visual warnings that would alert rescue personnel to the presence of an inflatable restraint system.

h. It must be shown that the inflatable restraint will not impede rapid egress of the occupants 10 seconds or later after its deployment.

i. For the purposes of complying with HIRF and lightning requirements, the inflatable restraint system is considered a critical system since its deployment could have a hazardous effect on the airplane.

j. It must be shown that the inflatable restraints will not release hazardous quantities of gas or particulate matter into the cabin.

k. The inflatable restraint system installation must be protected from the effects of fire such that no hazard to occupants will result.

l. There must be a means to verify the integrity of the inflatable restraint activation system prior to each flight or it must be demonstrated to reliably operate between inspection intervals.

m. A life limit must be established for appropriate system components.

n. Qualification testing of the internal firing mechanism must be performed at vibration levels appropriate for a general aviation airplane.

Issued in Kansas City, Missouri on September 4, 2013.

Earl Lawrence
Manager, Small Airplane Directorate
Aircraft Certification Service

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